

**Division of
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AFCI Testers

Article 210.12(B) of the National Electrical Code requires that AFCI protection be provided on all 125 volt single phase 15 and 20 dwelling unit bedroom circuits. The first question that was asked when this requirement was adopted was how will we test these devices. When they were first required the only way to test these was to use the "Push to Test Button" this worked until a manufacturer had problems in cold installations, at that point the "Push to Test Button" would not work if the device was cold. The Electrical Bureau was supplied with a three AFCI testers to test the devices. These seemed to work very well and seemed to be a good way to inspect AFCI circuits. The bureau then checked to see what testers were available and purchased enough for all of the state employed inspectors to use. The bureau soon found that these testers did not last very long and were failing during use. The bureau then had the manufacturer of the testers replace them. In August of 2004 we had a manufacturer recall their AFCI devices due to some kind of flaw in the devices. The bureau now has been told that the AFCI Testers will not test their product any more and that these testers are not testers but indicators. On February 10, 2005 the bureau had an opportunity to meet with a representative from UL and a representative from NEMA. The question we asked them was, are the AFCI Testers on the market today suitable/reliable for testing AFCI circuits? The bureau was told the only reliable and recognized way to test AFCI devices is to use the "Push to Test Button". The information to confirm this follows.

Arc Fault Circuit Interrupter Tester? Not Really.

The proper way to test an AFCI is to use the push-to-test button located on the device. Using an AFCI indicator, also referred to as an "AFCI tester," may yield confusing and conflicting results.

The electrical industry has always had a fascination with testers. There are testers for ground fault circuit interrupters (GFCIs), voltage drop, circuit polarity, circuit continuity and now the latest addition ... the arc fault circuit interrupter (AFCI) tester.

NEC 210.12 requires AFCIs on 15 and 20 ampere branch circuits that supply bedrooms in dwelling units. The intent of the AFCI is to detect hazardous arcing and turn off the circuit in order to reduce the potential of fire from an arc. AFCIs are available from a variety of manufacturers and have been installed in thousands of homes.

To capitalize on this new device, the AFCI "tester" has shown up in the market place. Many electrical inspectors and home inspectors have purchased the tester with the idea that it will tell them whether an AFCI is functioning properly. Unfortunately, confusing and conflicting results can occur.

Testers of many kinds can be very useful tools for accomplishing specific tasks and some are more useful than others. Before deciding whether a tester may be useful for the installation and inspection of AFCI circuits, you might find the following facts helpful.

The Nature of AFCI Designs

The UL standard for AFCIs (UL 1699) sets forth the requirements for the proper functioning of an AFCI. A number of the tests are efficacy tests that subject the AFCI to various arcing scenarios. The AFCI must detect the arc and open the circuit before the cotton fire indicator ignites at the arcing location. In addition, the AFCI has to be able to resist tripping under a number of "normal arcing" scenarios (e.g., thermostatically controlled contacts) that are established in the standard.

It is important to recognize that the standard does not set forth the method that a manufacturer must use to detect the hazardous arcing conditions and resist the normal arcing conditions. Manufacturers can utilize different and unique methods to achieve the expected result. Therefore, manufacturer A may use one algorithm for detection and manufacturer B may use something completely different. Both meet the standard and are acceptable AFCIs; they just get there by traveling down different paths.

This is an important concept to grasp in order to understand why the testers may not necessarily work properly in the field.

It's An Indicator, Not A Tester

The reality is that there is no portable AFCI tester on the market today. If one looks closely at the products, they carry a listing as an "AFCI indicator." UL 1436 – Outlet Testers and Similar Indicating Devices is careful to refer to an AFCI indicator, not an AFCI tester.

In fact, the standard recognizes the differing nature of arc detection and requires a marking or notation in the instructions¹ that states:

"CAUTION: AFCIs recognize characteristics unique to arcing, and AFCI indicators produce characteristics that mimic some forms of arcing. Because of this the indicator may give a false indication that the AFCI is not functioning properly. If this occurs, recheck the operation of the AFCI using the test and reset buttons. The AFCI button test function will demonstrate proper operation."

Because of the variation in AFCI designs, an AFCI indicator that may work with one manufacturer's product may not work properly with another. It is also important to remember that AFCI manufacturers are constantly improving their products. These improvements can also result in an AFCI that functions properly and meets that standard, but no longer works with a specific AFCI indicator.

In addition, the manufacturer of the AFCI indicator will not be familiar with the tolerances that are acceptable within the design of the AFCI itself. The AFCI indicator may function correctly with a device that falls into the middle of its tolerance band, but not work with one that is at the high or low end of the tolerance band, even though all of the devices represent a properly functioning AFCI.

Use the Test Button

To determine whether an AFCI is functioning properly, use the test button on the AFCI. Pushing the test button should result in the device opening. This is not a "mechanical" test. Pushing the test button imposes a simulated arcing condition on the circuit and the AFCI must be able to detect that arcing condition and open. If the device does not open, then the AFCI should be replaced. If the device opens when the test button is pressed and it can be reset, then it is a properly functioning AFCI and it has been "tested."

Don't Toss a Perfectly Good AFCI

As stated earlier, the best method for testing an AFCI is the integral test button. If the test button shows proper operation, then the AFCI is functioning correctly. This is true even if your AFCI indicator device does not trip the AFCI. It is unfortunate that some properly functioning AFCI have been replaced in the field due to a false indication of their status from an AFCI indicator. Upon return to the manufacturer, the AFCI is evaluated and frequently found to be functioning properly.

Summary

The bottom line is that the test button on the AFCI is the only recognized method for testing the proper operation of the AFCI. An AFCI indicator may be a nice way to determine if a particular circuit is connected to an AFCI, but it provides no definitive answer on whether an AFCI is properly working or not.

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Instructions

Operator Instructions

1. Always test on a known live circuit before use to assure the unit is in operating condition. (If insertion of the tester into receptacle. The combination of bright lights on the top or at the base of the unit indicates wiring sequence.)

GFCI Testing

2. If the receptacle under test is GFCI protected, you have automatically tested for nuisance tripping. (If insertion of the tester tripped the GFCI, either there is additional leakage to ground or the GFCI trip level is set too low.)
3. Consult the GFCI Manufacturer's instructions to determine that the GFCI is installed in accordance with the manufacturer's specifications.
4. Check for correct wiring of receptacle and all remotely connected receptacles on the branch circuit.
5. Operate the test button on the GFCI installed in the circuit. The red test light will turn on, indicating the activation of the GFCI test. The GFCI must trip. If it does not — do not use the circuit — consult a qualified electrician. If the GFCI does trip, reset the GFCI. Then, insert the Arc into the receptacle to be tested.
6. With the tester plugged into a GFCI receptacle and both outside lights lit, simply push the GFCI test button on top of the tester. The GFCI should trip and both lights should go out, indicating a properly functioning GFCI.
7. If the SureTest® Arc fails to trip the GFCI, it suggests: (a) a wiring problem with a totally operable GFCI, or (b) proper wiring with a faulty GFCI. Consult with an electrician to check the condition of the wiring and the GFCI.

AFCI Testing

8. Consult the AFCI manufacturer's installation instructions to determine that the AFCI is installed in accordance with the manufacturer's specifications.
9. Check for correct wiring of receptacle and all remotely connected receptacles on the branch circuit.
10. Operate the test button on the AFCI installed in the circuit. The AFCI must trip. If it does not — do not use the circuit — consult a qualified electrician. If the AFCI does trip, reset the AFCI. Then, insert the Arc into the receptacle to be tested.
11. With the tester plugged into the receptacle and both outside lights lit, simply push the AFCI test button on top of the tester. The blue test light will turn on, indicating the activation of the AFCI test. The AFCI should trip, and the blue AFCI light and wiring indicators should go out, indicating a properly functioning AFCI.
12. If the Arc fails to trip the AFCI, it suggests: (a) a wiring problem with a totally operable AFCI, or (b) proper wiring with a faulty AFCI. Consult with an electrician to check the condition of the wiring and the AFCI.
13. **Caution:** AFCIs recognize characteristics unique to arcing, and AFCI testers produce characteristics that mimic some forms of arcing. Because of this the tester may give a false indication that the AFCI is not functioning properly, when the problem is within the circuit. If this occurs, recheck the operation of the AFCI using the test and reset buttons. If the AFCI button test function demonstrates proper operation, consult with an electrician to check the condition of the circuit.
14. Warranty limited solely to repair or replacement; no warranty of merchantability, fitness for a particular purpose or consequential damages.



Recently, there have been a number of questions from the field about the response of arc fault circuit interrupter (AFCI) circuit breakers to commercially available AFCI indicators. AFCI indicators operate by producing a waveform similar to an arc fault. However, because they cannot produce an actual arc fault, an AFCI indicator may not trip every available AFCI.

Therefore, if an AFCI indicator plugged into a receptacle protected by an AFCI does not trip the AFCI, it does not mean that the AFCI protecting the circuit is defective and needs to be replaced. When this situation occurs, you should push the "Test" button provided as an integral part of the AFCI itself. If the integral test button does not trip the AFCI circuit breaker, it should be replaced.

To notify users of this product limitation, Underwriters Laboratories Inc. requires AFCI indicators to be marked or be provided with instruction manuals that state the following or equivalent:

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CAUTION: AFCIs recognize characteristics unique to arcing, and AFCI indicators produce characteristics that mimic some forms of arcing. Because of this the indicator may give a false indication that the AFCI is not functioning properly. If this occurs, recheck the operation of the AFCI using the test and reset buttons. The AFCI button test function will demonstrate proper operation.

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For more information on AFCI indicators, contact Steve Brown in Melville, N.Y., by phone at +1-631-271-6200, ext. 22420; or by e-mail at Steven.A.Brown@us.ul.com. If you find a defective AFCI, please alert the product's manufacturer and UL through UL's AHJ Product Report Form available online at <https://www.ul.com/regulators/ahjprod.cfm>.